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TRANSACTIONS

OF THE

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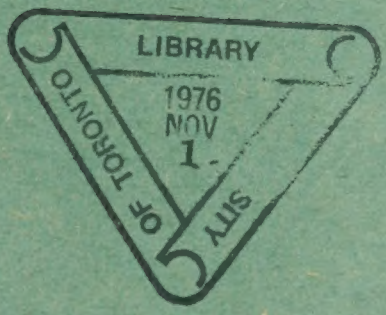

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TRANSACTIONS

OF THE

SOCIETY OF TROPICAL MEDICINE AND HYGIENE.

OCTOBER 18TH, 1918.

VOLUME XII. No. 1.

Proceedings of a Meeting of the Society held on Friday, October 18th, 1918, at 5.30 p.m., at 11, Chandos Street, Cavendish Square, W. 1., Surgeon-General Sir DAVID BRUCE, K.C.B., F.R.S. (*President*), in the Chair.

THE SANITARY ASPECTS OF WARFARE IN SOUTH-EASTERN EUROPE.

BY PROFESSOR W. J. R. SIMPSON, C.M.G., M.D.

THE EXCELLENCE OF THE MEDICAL AND SANITARY ARRANGEMENTS IN FRANCE.

I propose to bring before the Society a general survey of the sanitary aspects of warfare in South-Eastern Europe rather than any details regarding my individual experience in the Balkans.

Until the treaty of Brest-Litovsk there was in this war a Western and an Eastern front in Europe. There is now a Western and a South-Eastern. Throughout the war the Western front has been distinguished for the wonderful success of its medical arrangements. In no former war have such brilliant results been attained in the surgical, medical, nursing, administrative, scientific and sanitary sections.

The splendid organisation of the hospitals, the transport of the wounded and sick, and the remarkable results which have attended the treatment in hospital of the sick and wounded have secured the unqualified admiration of those who have studied them. Similarly the comparative freedom from epidemic disease owing to the sanitary administration has rendered the four years' war unique in the history of wars in France. Side by side with these there have been scientific investigations which have added much to our medical knowledge, among which may be mentioned the infections of wounds and their prevention and treatment, and the research into trench fever.

THE SANITARY PROBLEM MORE COMPLEX IN SOUTH-EASTERN EUROPE.

When we turn to the South-Eastern front we find the same excellence in the British hospital and medical arrangements, although in an area far from England, with its corre-

sponding difficulties of transport and supplies accentuated by the nature of the countries concerned. The campaign, however, is conducted in areas subject to great ranges of temperature between summer and winter, and where, owing to the domination of the Turk for over 500 years, the inhabitants live under more or less primitive conditions, without any special organisation for or attention to the preservation of health.

Wars in this region have always been distinguished for much sickness and mortality, and it is because I think that information gathered from what has already happened may be useful in securing the adoption of more effective measures in these and in tropical countries, where the sanitary problems are much more complex than in France, that I am reading this paper.

South-Eastern Europe the Gateway of the East and West.

The South-Eastern corner of Europe has always been a great fighting arena. It is the gateway on land to the East and for the West, and as such its possession has been coveted in turn, and fought for by the rulers of expanding empires on either side of it from the earliest times. The last of the great Powers in possession is the Turk. For the past 200 years Austria or Russia, alone or together, have attacked Turkey with the object of taking her place, and they have considerably reduced her hold. Now it is the ambition of Germany, in alliance with Austria, to become heir to the Turk.

Germany remembers that Alexander the Great with a well-trained army, and without railways or other modern means of transport, started from the Vardar Valley, defeated the Persians—the most powerful nation of that time—conquered Palestine and Egypt, destroyed the Persian imperial power at Arbela, and extended his conquests to Afghanistan and India. It was only war-weariness of the soldiers, after nine years of incessant warfare, that prevented him from adding India to the Macedonian empire.

Germany hopes, and I do not for a moment believe she will discard that hope, whether as an empire or a republic, that she will one day be in possession of the gateway, or so control it that she will be able with her Allies to attack the British Empire at a vulnerable spot and threaten our possessions in Africa and Asia. If she cannot retain the gateway in this present war by force, nor by diplomacy cheat the Allies, she will, I think, unless great foresight be shewn, endeavour to do it in times of peace by colonisation and bide her time. It is not without purpose that the Serbian population has been largely exterminated and scattered. It makes it easier to colonise and to occupy by peaceful penetration.

Sickness and Mortality in the Early Wars.

Although the chief interest necessarily centres in the sickness and mortality that have occurred in the war of to-day, yet some of the events in the more remote times are not without their lesson. For instance, it is germane to the subject to recall the fact that the immense army of Xerxes on its retreat through Thessaly and across the Vardar Plain, and that portion of the country now occupied by the British troops in the Struma Valley, suffered from hunger, dysentery and pestilence to such an extent that the greater part of it perished, and when the remnant reached Abydos the major portion died, though food and water were plentiful. In the accounts of the wars between Austria and Turkey and between Russia and Turkey in the eighteenth and early part of the nineteenth century, the invariable story is one of much sickness and mortality from intermittent fevers, dysentery, typhus fever and plague, and from the effects of a bad commissariat. The infection of typhus and plague were not confined to the armies, but spread to the civil population, who, in their turn, infected the soldiers billeted in the villages and towns. It was largely owing to these frequent wars, with their movement of armies and refugees from place to place, that plague continued in South-Eastern Europe for more than 100 years after it had disappeared from Western Europe. It at last disappeared from Turkey in the middle of the nineteenth century. The Crimean war had no plague, but there was the usual prevalence of intermittents, typhus fever, dysentery and scurvy in the armies, and in addition to these cholera. This disease had been brought to Gallipoli with the

French troops from France, where it was epidemic. It exercised a considerable influence on the course of the campaign, being the cause of the French army having to retreat from the Dobrudja. The disease spread from the armies and caused great havoc among the civil population.

In the Russo-Turkish war of 1878 9 the Russians lost by death from typhoid, typhus and relapsing fever some 24,000 men out of an army of less than 400,000, while dysentery and intermittent fevers prevailed as usual. The Turkish troops suffered to a corresponding degree.

Disease among the Serbs in the Balkan Wars of 1912–15.

The three Balkan wars, beginning in 1912 and not yet ended, have likewise maintained the bad reputation for unhealthiness which has always distinguished wars in this region.

In the first war in 1912 between the Balkan States and Turkey we heard in England much of the doings of the Bulgarians and Greeks against the Turks, but little of the important victories gained by the Serbs, who signally defeated the Turks at Koumanovo, in what is now considered the decisive battle of the campaign. The Serbs sent 30,000 of their men to Adrianople, and by their superior artillery materially assisted the Bulgarians to capture that city. They moreover defeated the Albanians and Turks, followed their retreating armies in the depth of winter through the mountains and inhospitable wilds of Albania, conquered that country, entering Scutari and Durazzo, and came into possession of all that region which formerly belonged to ancient Serbia. In doing so, this portion of the Serbian army came in contact with the typhus fever which is endemic in Albania, and brought the infection back with them and with their prisoners to Serbia, where for many years past it had been unknown.

The first Balkan war, however, was a short one, and there was little time for the appearance of the usual war pestilence to any great extent. There was, however, sufficient time for typhoid fever and dysentery to prevail, and there is also the outstanding fact that the prevalence of cholera among Turkish troops in the Chatalja lines and in Constantinople, together with the check to the Bulgarians inflicted by the Turks, helped in some degree to prevent that city falling into the hands of the Bulgars. Some 18,000 cases of cholera occurred in the Bulgarian troops, but energetic measures were taken by the Bulgars—under foreign direction—to prevent its extension.

The second Balkan war was also short. Bulgaria, not content with the division of the spoils and hankering after Macedonia, suddenly, without warning, attacked the Serbs and Greeks. The war began on the 30th of June and ended in August with the defeat of the Bulgarians. Cholera, however, which had not affected the Serbs in the previous campaign, now attacked them, and in a short time 7,000 of their soldiers succumbed to this disease. I am informed there is an interesting history attached to this outbreak. Before the war a distinguished Austrian professor was consulted as to the value of inoculation against cholera, and his opinion was such that the Serbians did not feel justified in employing this prophylactic. Nevertheless the Austrian army was inoculated against cholera, the professor having changed his opinion later.

It is interesting to note that in 1916 the tetra-vaccine prepared by Castellani, and consisting of typhoid, paratyphoid A, paratyphoid B, and cholera bacilli, was used by the American Red Cross on a large scale in Serbia and was officially adopted by the Serbian army, and is now used to this day with good results.

Before Serbia had time to recuperate after the Turkish and Bulgarian wars she was plunged into a third. The new arrangements in the Balkans interfered with Austrian and German plans of extension and control in the East. On the 28th of July, 1914, Austria declared war against Serbia. Taken more or less by surprise, the Serbian army had to cede territory where invaded in order to prepare to meet so formidable a foe. The invasion was announced to be a punitive expedition, and under this name Austria inflicted cruelties and atrocities on the civil population which remained behind equal to if not worse than those of the Germans on the Belgians. The triumph, however, was short lived. The Austrians were badly defeated and driven out of Serbia with a loss of 20,000 prisoners.

In a second offensive the Austrians were again defeated and 4,000 prisoners taken. In a third invasion in November, 1914, the Austrian army succeeded in reaching Valyeyo, but shortly afterwards the Serbs won a great victory over the Austrians, drove them out of the country a second time and captured some 70,000 prisoners and an immense quantity of booty. This was in December, 1914. This marvellous success over an army exceeding five army corps in strength was, however, followed by an event disastrous to the Serbs. When the Serbian army and the civilians who had fled from the invaded territory reoccupied the towns and villages which had been in the hands of the Austrians there sprang up an epidemic of typhus fever, which soon spread in every direction and attained an immense magnitude. The previous infection of typhus fever from Albania, which had created no alarm, was now heavily reinforced by a strong infection from the Austrian soldiers, who had brought it with them from their own country. According to Colonel SOUBBOTICH, who read a paper before the Epidemiological Society in January of this year, the whole Serbian country became flooded with typhus, and although the epidemic was heroically dealt with by the British, American, French, and Russian missions sent out to assist, in which Dr. ELSIE INGLIS, Colonel WILLIAM HUNTER, A.M.S., and Dr. RICHARD STRONG, of the American Sanitary Commission, rendered such excellent service, at least 150,000 of the Serbian soldiers and Austrian prisoners were attacked, of whom not fewer than 30,000 died. Out of 350 Serbian doctors 126 succumbed to typhus fever, the death rate being 36 per cent.

Colonel SOUBBOTICH mentions one of the military hospitals, which in peace time had only beds for 400 patients, receiving 1,600, of whom 1,000 were suffering from typhus fever, and in which, out of a staff of 42 doctors, dispensers, auxiliary doctors, dressers, and nurses, only three escaped infection. It is impossible to estimate the number of the civilian population that was affected and died of the disease. He states that the disease was recognised as typhus fever in December, 1914; it continued in full force through January, February, and March of 1915; in April it died down and ceased in June. This epidemic, like all epidemics of typhus, was seasonal in character. The cessation in June is an interesting epidemiological fact. With typhus fever was associated an epidemic of relapsing fever, but these were not the only epidemics that had to be contended with. An epidemic of sand-fly fever is recorded as having occurred in August, followed in September by an epidemic of malaria, which Colonel CASTELLANI describes as having a very protean character, a large number of cases being of the comatose type. He records also an epidemic at Geogheli in September, 1915, which was reported to be typhoid fever, but 90 per cent. of the cases of which, when investigated by Dr. STRONG, of the American Sanitary Commission, Dr. JACKSON and Colonel CASTELLANI, turned out to be subtertian malaria of a typhoid type. This reminds me of an incident that came under my own observation. A company of French soldiers came from the environs of Monastir to Sorovich to rest, and were shortly attacked by what was diagnosed as dengue. The result of a microscopical examination of their blood shewed them all to be suffering from malarial fever of the benign tertian type.

SICKNESS IN BRITISH ARMY IN GALLIPOLI.

While these events were happening in Serbia, disease was seriously affecting the British and French forces in Gallipoli. Of British troops alone, over 96,000 had to be removed from the peninsula from sickness in less than seven months, the great majority of these occurring in August and September.

The actual figures relating to casualties were stated in Parliament on December, 1915, as follows:—

DARDANELLES.

	Officers.	Men.
Killed	1609 ...	23670
Wounded	2969 ...	72220
Missing	337 ...	12114
	4915 ...	108004
Sick (all ranks) ...	... ...	96663

This number of sick did not include those who remained on the peninsula in spite of being ill.

It may be of interest here to note that the total number of sick in the Boer War for the 2½ years was 63,644. It has always been held that the sickness in the Boer War was abnormal.

Sickness and Mortality during the Serbian Retreat.

At the time of the sickness at Gallipoli, the Russian armies, needing food and military supplies, had been forced by Mackensen's victories to retreat from the Carpathians. This retreat exposed Serbia later to a fourth invasion of the Austrian army. The Serbs, weakened by the typhus epidemic and the previous campaigns, were in an ill condition to resist with any possibility of success an attack by the Austrians and Germans under the leadership of Mackensen on the one side, and by the Bulgarians, who had now joined the Central Powers, on the other. The Serbs, foreseeing that they would thus be attacked, had asked the Allies for 250,000 men; Venizelos was content if the Allies would send 150,000. In October, 1915, the Allies began to arrive, and mustered at first 22,000, and others quickly followed. They advanced to the rescue of the Serbs, who were putting up a stout resistance against overwhelming odds, but they were too few to pierce the wedge which the enemy had placed between the Allied and Serbian armies, and all prospect of a junction was destroyed. The Serbs had now the choice to surrender or retreat through Albania to join the Entente later. The latter choice was made, and then began that memorable and tragic retreat in which the Serbian armies left their country, marched through a hostile and mountainous country in the depth of winter, fighting against their enemies eager to cut them off or destroy them, until they reached the Adriatic, and were thence transported to Corfu. Before Corfu was reached the result of this retreat was the loss of over 100,000 men from hunger, exhaustion, disease and wounds. Less than 140,000 reached Corfu. Of these, even in this haven of rest, where every effort was made to bring them back to health, 10,000 died during the first two months from disease, typhus fever, relapsing fever and famine diarrhœa being the chief. Colonel Castellani, who was lent as Principal Medical Officer to the Serbian Relief Fund, has published photographs of the condition of some of these soldiers. Here is one. They resemble the state of many of the children of refugees in Macedonia in the Monastir district in 1917, and for whom the Serbian Relief Fund has done so much. After a period of recuperation in Corfu, a considerable Serbian army was able to join the Entente armies in Salonika.

Difficulties Connected with the Salonika Campaign.

A glance at the map will show some of the difficulties of campaigning in the Balkans. It is a country of mountain ranges, deep valleys and fertile plains studded with lakes and marshes, and with rivers and streams that overflow their banks. The plains are separated by precipitous hills and mountains from which spurs stretch out in different directions forming subsidiary valleys; the passes between the plains are often narrow and at a considerable height; on the slopes of the hills and mountains watercourses abound, which bring down immense quantities of storm water from the higher ground, and which, meeting, form the tributaries of rivers or flow into the many lakes and marshes. The Struma river flows into the Tahinos lake before it reaches the sea. Besides the rivers, marshes and lakes in the plains there are not infrequently springs coming to the surface, and they in their turn produce marshy ground; near the sea coast, in those parts where the hills or mountains are not far from the sea, springs, lakes and marshes abound. Macedonia is one of the most malarious parts of Europe, the physical features lending themselves to the prevalence of malaria once the infection has been introduced and established. The country has few roads except those that have been made by the Allied forces. From Salonika there are three railways, one passes westward, crosses the great Vardar plain, which is little higher than sea level, and terminates at Monastir, which is over 2,000 feet above the sea level. Owing to the hills dominating this town being in the hands of the Bulgars, the terminus until lately was at Florina, the headquarters of the French command. A second railway goes north and follows the Vardar Valley, and the third also goes north until it

reaches the Doiran Lake, then eastward to the Rupel Pass—which reminds one of the treachery of the Greek King—there it crosses the Struma river and turns south proceeding to Seres and thence to Drama—all well-known names in the fighting that has taken place in the British sector.

The road to Monastir by the Via Egnatia is more direct than the railway. It passes the Wells of Pella, the only remains except a small part of a thick and massive wall of the capital of Alexander the Great. The water is brought from the neighbouring mountains by aqueducts and conserved in large reservoirs. It is a dreary journey by the road, especially in winter, if the chilling Vardar wind is blowing, until one reaches Vertekop, which is sheltered and where two British hospitals are located. Both have been bombed by German aeroplanes, causing fatalities. In one of these, under the admirable administration of Colonel Fraser Clark, I had the pleasure of seeing the excellent pathological and diagnostic work that Captain Graham Forbes and his colleagues were doing, and of inspecting the drainage work near to the hospital which he was instrumental in carrying out, and which, joined on to the larger works in the marshes in the plain completed by the French Anti-Malarial Commission, had improved to a very great extent the health conditions of the hospitals.

From Vertekop there is at first a gradual and then rapid ascent to Vodena, a beautifully situated town in the hills, looking down on and commanding the Vardar plain. Water is so abundant that Vodena signifies a place of water. It was another of Alexander's residential towns. Higher up, the road passes by Ostrovo, where the Scottish Women's Hospital, overlooking the Ostrovo Lake, some 1,700 feet high, is situated, then past Kaimachalan on the right, a mountain nearly 10,000 feet high, which was stormed by the Serbs, and which, together with the taking of Gornechevo and Banitza and the range above it, forced the Bulgars to retire from Sorovich and Eksissu. These two towns in 1917 became centres for Russian, British, Serbian and French hospitals. With the capture of Monastir, the front very soon extended from Lake Ochrida and Prespa on the west front, along the range of mountains to Lake Doiran and to the Struma Valley, where the River Struma discharges into the sea on the east.

I spent some eight months in the Monastir district as Principal Medical Officer for the Serbian Relief Fund, whose activities embraced not only medical aid in hospitals and dispensaries established and maintained by the fund for Serbian soldiers and refugees who had fled from their homes, but also the provision of comforts in the form of food and clothing. When I left at the beginning of this year there was one small ambulance hospital at Lake Prespa, a larger one at Monastir, another at the Tcherna bend, a dispensary at Kenali, another at Jevonia, and the principal hospital at Kremyan—at one time this was at Sorovich in Greek territory.

I had exceptional opportunities of seeing and studying the conditions existing in nearly all the sectors occupied by the Russian, French, Italian and Serbian troops; also the state of villages and towns in Greek and Serbian Macedonia. I saw the great work the French Anti-malarial Commission was carrying out. In January of this year I was given facilities by my friend, General Sir Maurice Holt, Director of Medical Services of the British Salonika force, to visit the Struma Valley and examine the conditions there, and was asked to make any suggestions which might be of assistance in improving these conditions or in lessening the chances of malarial infection, as he was anxious to do all that was possible to protect the troops. In complying with this request, I submitted a short report which, while giving credit for what had already been done, contained certain suggestions which I understand have been or are being carried out.

The chief towns in Macedonia are Salonika, Vodena, Sorovitch, Florina, and Monastir; the first and last possess very fine buildings, but in Salonika fleas, bugs, mosquitoes, and flies abound, as they do in the other towns. Colonel Balfour, in a lecture delivered at Salonika, gave an excellent description of these insect pests. Most of the inhabitants live in villages; some of these, such as Batachin, on the lower slopes of Kaimachalan, inhabited by shepherds, who keep their flocks and cattle away from the village, are clean and the houses well built, but in the majority of villages the inhabitants dwell in houses of a primitive construction, badly lighted and ventilated, and in which

the fowls, pigs, and donkey occupy one end of the living room and the family the other. When the house is two-storied the family live upstairs and the animals below. It is under these conditions that there is every opportunity for the diseases of animals to be conveyed to man, and *vice versa*. There is one village in which we had a dispensary hospital, and which had been named many years ago the "Empire of the Fleas." Many of the patients admitted to hospital, sometimes suffering from malaria, sometimes with some other dangerous illness, were so abundantly covered with flea-rash that unless carefully examined the impression was given that they were typhus fever cases. The water supply in many places, especially in those near the foot of the hills, is good, owing to its origin from springs, but wherever there are wells they are polluted with filth ; latrines, kitchen, and well are usually close together. There is much dysentery among the civil population, both bacillary and amœbic, the former being the most prevalent ; but the two diseases which bulk the largest are malaria and tuberculosis. Nearly every illness among the civil population was associated with one or both of these diseases. Among the refugees diseases of malnutrition were common. It was in a country of this description that military operations had to be carried on. Roads had to be made and fighting maintained while the Greek king with an army in Thessaly was intriguing and helping the enemy.

Sickness in the Allied Armies in 1915 and 1916,

Under the circumstances great caution had to be exercised. This meant delay, and delay in a malarious and insanitary country, where the troops undergo great fatigue and are unprotected, is dangerous. By the time Monastir was taken by the Serbs and French in November, 1916, and the British were fighting in the Struma Valley, the toll of sickness from malaria, sand-fly fever and dysentery had been enormous. The British troops perhaps suffered in a less degree than the French except in the Struma Valley, where all the regiments were more or less affected, some worse than others. It is not surprising that the name which the Allied Armies received was the "Phantom Armies." Let me give you one example. A regiment entered the Struma Valley 900 strong. In six weeks there were only 200 left not in hospital.

The French Anti-malarial Commission.

It was in 1916 that the Pasteur Institute recommended to the Government of France that two tropical experts should be sent out to study the malarial situation. This was agreed to, and the brothers Sergent from the Pasteur Institute of Algeria were selected for the mission. As a result of their investigations they reported that it was essential that a Commission—not an advisory Commission, but one endowed with executive powers acting under the Director of the Health Service of the Army of the East to secure the necessary support for its work—should be immediately sent to Macedonia to carry out anti-malarial measures. This Commission, of which Dr. Visbecq was chief, arrived in Salonika in March, 1917, and there was formed under his presidency an inter-allied Commission, with its headquarters in Salonika, to work out and put into practice the necessary measures in their respective spheres. As I had every opportunity of seeing the anti-malarial work that was done in the different parts of Macedonia during the year 1917, I have no hesitation in saying that the inter-allied Commission accomplished a great deal in a very short time, and that its services were of the highest value. Dr. Visbecq, before I left Salonika, kindly furnished me with maps and particulars of the operations conducted by the Commission, and it had been my intention to place these, together with an account of the measures taken, before the Society at the last April or May meeting, had the opportunity presented itself. I shall now only refer to a few details, as the Commission's Report is published in the June number of the *Bulletin de la Société de Pathologie Exotique*, and can be read by all those interested.

The need of the work which the Commission undertook and the systematic way in which it was carried out are shewn by the maps taken from their Report. The first map shews the splenic index of the civil population under fifteen years of age, taken by Drs. Sergent, during the winter of 1916-17, in the principal camping grounds from

Salonika to the Monastir front and up the Vardar Valley. The percentage of enlarged spleens in some of the localities was 73·2, 61·6 and 56·7.

The second map represents the splenic index in the summer of 1917, as found by the French Anti-Malarial Commission in the towns and villages in that portion of the country in which French, Russian, Italian and Serbian troops were passing through or located.

The other maps shew the same in different parts of the country.

At the same time as these investigations were being made, the more practical work of the Commission proceeded, and consisted in distributing among the regiments and hospitals circulars and post-cards illustrative of the dangers to the soldier of the bites of mosquitoes, providing mosquito nets for bivouac tents and hospitals, issuing veils, carrying out large and small drainage works wherever marshes were close to camping grounds, filling up small excavations close to camps, and occasional oiling, but the latter had to be done sparingly owing to scarcity of oil. Quinine rations were also issued. In the Struma Valley similar measures were introduced. In this valley there was an additional precautionary measure taken, and this was that during the summer the greater part of the troops were withdrawn from the valley to the hills that overlooked it, only sufficient troops being maintained in the infected area to guard the outposts.

In regard to veils, I shewed the Society last year one invented by my wife just before I started for Salonika, and which she calls the "Simpsonette." (It is described in Volume X., No. 7, June, 1917, of the TRANSACTIONS of the Society.) She has greatly improved it. Hoods in future will be made non-inflammable with smokers. All the veils carried about in one's pocket or fastened above the helmet are quite useless as a protection against mosquitoes at night; they are useful to keep off flies from the face during the day, but that is all. I now shew the two kinds that have been found most useful. In future wars in a malarious country I believe the soldier will wear during the evening and night a mosquito headgear, just as he now wears in the Tropics during the day a sun helmet.

COMPARISON BETWEEN THE HEALTH CONDITIONS OF TROOPS IN FRANCE AND THOSE IN SOUTH-EASTERN EUROPE.

I think the account I have given shews that South-Eastern Europe is an unhealthy area for warlike operations, and that though disease has fallen very heavily on the armies of those countries who do not pay the same attention to hygiene as we do, yet in this war the Gallipoli and Salonika experiences demonstrate that the sanitary organisation and measures which have been so effective in France have not been sufficient for armies operating in countries where malaria exists, and where sanitation is in a very primitive state. This state of affairs as regards the preventive side of disease in our armies as distinguished from the hospital and curative side, for which there cannot be but the highest praise, is emphasised also by what happened in Mesopotamia, East Africa, and Egypt. It appears to me that our sanitary organisation for campaigns in tropical and sub-tropical countries must be submitted to a thorough examination, and be reorganised on a very different basis from that which now exists. I gave expression to these views as early as June, 1915, but they were unfortunately disregarded. I repeated them in an article which appeared in the *Journal of Tropical Medicine and Hygiene* of December 1st, 1916, on "The Need of an Organised Application of Tropical Hygiene to Prevent Excessive Wastage from Disease in our Armies in the East," and it was followed later by a letter of mine in the *Times* on the same subject.

These views can be held without in any way diminishing the importance and magnitude of the work done by the British Sanitary Service in France. The results are written large in the health conditions of the army there, and no one realises and appreciates that success more than I do. The reason for my views is that the conditions under which the armies are operating are different, so that what has been found adequate for the West is not so for the East, nor for the Tropics. In the West the armies are waging war—

(i.) In a temperate climate.

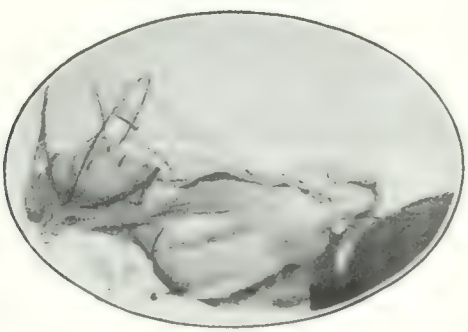
ANTI MOSQUITO AND FLY PROTECTIVE HEADGEAR (PATENTED)

INVENTED BY MRS. MARY SIMPSON.

No. I.

WORN UNDER THE HELMET.

WORN ABOVE THE HELMET.



WORN LYING DOWN OR ASLEEP.

ANTI-MOSQUITO AND FLY PROTECTIVE HEADGEAR (PATENTED)

No. I.

FRONT VEIL THROWN BACK, ACTING AS A PROTECTION FOR THE NECK

(ii.) The operations are near England and the base of supplies, whether it be food, equipment, ammunition, or other requirements for warfare.

(iii.) France, except in regard to typhoid fever and dysentery, is a comparatively healthy country.

(iv.) There was from the commencement a highly trained medical service for war and a small but well trained sanitary service to deal with the hygiene of camps, the movement of troops and lines of communication, water supplies were protected and treated, arrangements were made to give the soldiers baths and disinfect their clothing and blankets to free them from vermin, etc., while the beginnings of infectious diseases that might appear were promptly checked.

(v.) The troops were inoculated against typhoid fever and vaccinated against small-pox.

(vi.) The only trouble was trench fever, the causes of which were not understood, but in consequence of the researches carried out in France by the American Red Cross Commission, of which Major RICHARD STRONG was Chairman, and by the investigations in this country, under the direction of our President, Sir DAVID BRUCE, the methods of dissemination of this disease have now been made clear. It is hoped, therefore, that a systematic and organised effort will be made to apply this knowledge. Without this application the knowledge gained by the investigation is of no practical value.

(vii.) The sanitary organisation for the troops in France is such as to have attained remarkable success, considering the conditions under which it had to work.

In the East, on the other hand, in Macedonia for instance –

(i.) The climate is extremely cold for a short time in the winter and semi-tropical for many months in the year.

(ii.) The operations are a great distance from England and France and the base of supplies.

(iii.) Supplies of all kind are very difficult to obtain owing to submarine attacks

(iv.) The area in which the troops are engaged is very insanitary and extremely malarious; the water supplies are polluted, and there is an abundance of fleas, bugs, lice, flies and mosquitoes.

(v.) The armies have suffered from much sickness and mortality, causing a serious loss of effective strength, a great strain on hospital staff, and the need of a multiplication of hospitals, with their attendant expenses, which otherwise could have been avoided.

(vi) This condition of affairs demonstrates that the sanitary organisation for the army is not effective where operating in a notoriously insanitary country, while the experience in Egypt, Mesopotamia and Palestine also demonstrates that it is not sufficient to preserve an army in a state of health in a tropical climate.

(vii.) The International Anti-malarial Commission has done and is doing splendid work to mitigate some of these conditions, but as it began work 18 months after the Allied troops landed, it did not prevent disease in the early and important stages of the campaign.

The arrival of an Anti-malarial Commission 18 months after operations begin, may be advocated on the plea that it is never too late to mend. But certainly, from a preventive point of view, the sanitary officers and staff should arrive if not before, then at the latest with the first staff officers.

The dispatch of this Commission, which was an executive Commission, at least is an acknowledgment that a special working staff to combat malaria was required.

SUGGESTIONS FOR REORGANISATION OF SANITARY SERVICE IN UNHEALTHY COUNTRIES AND TROPICAL REGIONS.

It is necessary that the whole attitude towards preventive medicine should undergo a change. To wait until disease and epidemics occur is not prevention, however strenuous the efforts afterward to suppress them may be.

It is merely adopting the same system for a town or district, or regiment or division, as is employed when an individual falls ill. The doctor is called in, and in both cases the method is curative. It is certainly not preventive.

There are certain changes and additions which I would advocate to secure more

efficient prevention of disease in armies that are destined to fight in tropical and sub-tropical regions and in unhealthy and malaricus countries. First of all I am not impressed by the position given to the Sanitary Officer, or to the sanitary service. As rank is equivalent to power in the army, I venture to suggest that the Sanitary Officer of the army should be given a higher position, and that under the Director-General it should be a distinct branch endowed with more executive power.

I suggest for consideration, and I do so because we are now dealing with a national army—

1. That the Director-General should be on the Army Council. In this capacity he would be the Minister of Health for the Army. As a member of the Army Council he would be at once in possession of all the plans that are likely to be formulated, and be in a position immediately to arrange his medical and sanitary services accordingly.

2. There should be two branches under him: the Medical with its different sections, and the Sanitary with its sections. The chief of each branch should have the rank of a major-general. They can always be in close touch with each other in matters which are in common.

3. Each of them should have their Advisory Boards, and on them specialists in their respective departments. The duties of the Tropical Sanitary Board would be the co-ordination of sanitary measures, the recommendation of supplies, the recommending of suitable sanitary officers for the East, and the performance of duties in sanitation similar to those of a general staff, in its preparation of plans for prevention and watching the progress of sickness and epidemic diseases with a view to their prevention. The plans should be prepared in times of peace, and, like the plans of the military staff, should be ready at the first indication of war to be put into operation. Tropical sanitation includes something more than sanitation in cool climates. In order, however, not to multiply Boards, the two representatives of sanitation who were on the Army Medical Advisory Board should be transferred to join the Tropical Sanitation Board.

4. There should be Inspector-Generals of Sanitation for each Army Corps as Consultant Sanitary Officers, and advisers to the Generals and the administrative and executive sanitary officers, and to report on the efficiency or otherwise of the measures employed. They should proceed to the seat of war at the same time as the General Staff, and be in close touch with the Headquarters Administrative and Executive Sanitary Officers.

As regards the higher local administrative and executive sanitary officers, they should be quite distinct from the medical branch. True, much has been and can be done by preventive inoculations against bacterial diseases, such as cholera, the enterics, pneumonia, etc., but the insect-borne diseases need measures of a different order, requiring a very careful and systematic organisation, all kinds of equipment, and a labour organisation; so does the water supply, which is not always rendered safe in semi-tropical and tropical regions by chlorinisation. The food and vegetable supply also needs careful attention. The duties of these administrative and executive sanitary officers involve so much detail and attention to sanitary supplies, equipment, sanitary works, to inspections, consultations and provision of labour, staff and material, that they can never be effectually carried out if combined with other duties. Close touch is necessary, not only with the Statistical, Intelligence, and Bacteriological Departments, but also with the Labour and Engineering Departments, and the Sanitary Department should have depots of their own for the ordinary materials they require.

In addition to the ordinary regimental sanitation there needs to be an organisation for the larger works connected with brigades or divisions, for camps and lines of communication, and for this sanitary officers of rank are required. There is no use sending a captain or a major to a general, and if recommendations are sent through a higher medical officer, possibly not interested in sanitation, they may miscarry.

General sanitation of the district should be quite separate from the duties relating to field ambulance hospitals.

I hope this paper—which purposely has not dealt with details—will be sufficient to give rise to a useful and instructive discussion on the subject by those who have personal experience of warfare in the Near East and in the more tropical regions. We possess the knowledge, but I am convinced we have not the organisation to apply that knowledge in a manner that will safeguard our armies in the East from preventable disease.

ANTI MOSQUITO AND FLY PROTECTIVE HEADGEAR (PATENTED).

INVENTED BY MRS. MARY SIMPSON.

No. II.

WORN UNDER THE HELMET.

WORN ABOVE THE HELMET.

SMOKER TUBE IS USED FOR DRINKING WATER OR TEA THROUGH GLASS TUBE.

WORN LETS DOWN OR A VEIL.

FILARIAL INFECTION IN MACEDONIA.

Report of Two Cases of Filaria Conjunctivæ (Addario) in Man, with the First Recorded Discovery of the Male Worm.

BY

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Search into the literature on the subject of Filariasis yields evidence of the extreme rarity of infection by *Filaria conjunctivæ*—a condition confined in its geographical distribution to the south-east of Europe, known to occur in horses and asses, its normal hosts, and incidentally but seldom developing in man.

Records of six examples of human infection exist, and in every case the solitary female worm, usually immature, only has been found.

The first of the two cases to be described provides the only occasion hitherto recorded of the discovery of the male type of *F. conjunctivæ*. Although this parasite, first so named in 1885 by Addario,[1] was obtained from the eye, it is not necessarily restricted to that region; for it has been described in 1906 by Alessandrini[2] as occurring in the forearm, in a case very similar to that recorded here.

The two patients, one of whom—a private in the R.A.M.C., with eighteen months' service in Macedonia—had not previously been out of England, the other a Serbian, came under treatment at the same general hospital attached to the Royal Serbian Army, the former in February, the latter in June, 1918.

Case I.—Pte. J. B., R.A.M.C., one morning, early in December, 1917, noticed irritation, redness and slight swelling on the outer side of the upper part of his left forearm, and, in the skin over it, two small puncture marks, which suggested to him the bite of an insect. During the day this became a definite lump, about the size of a filbert nut. As the lump was quite painless he gave it little further attention at the time, although it shewed no signs of disappearing. Two weeks later the whole of the outer part of the forearm became swollen, hot and red, but still free from pain. It remained so for three days and then subsided, leaving the original nodule as before. This swelling up of the forearm recurred at intervals of about ten to fourteen days, was never painful, and lasted about three days, but did not interfere with his duties as batman.

At the fourth recurrence he applied for treatment. It was decided to wait until the swelling had subsided, and a fortnight later, early in February, he was admitted to hospital under Capt. Lees, M.C., for operation.

On incision through the skin of the upper part of the forearm, a small tumour was found firmly embedded in the subcutaneous tissue overlying the head of the radius and the sheath of the supinator longus muscle, so that it could only be removed by dissecting out from the surrounding tissues. The tumour resembled a lymphatic gland, measuring $1 \times \frac{2}{3} \times \frac{1}{2}$ inch. On incision into the substance of the nodule, a thread-like worm suddenly protruded for a distance of $\frac{3}{4}$ inch. The specimen of both tumour and worm was then sent to the laboratory for detailed investigation.

Two days after the removal of the nodule, the epitrochlear gland from the same arm was excised for microscopical examination. The subsequent course of the case was uneventful. The operation wounds healed by primary intention, and the patient has remained well ever since.

Pathological Report.—Gentle traction on the end of the worm protruding from the

tumour resulted in its complete removal, but in three portions, the original incision into the excised nodule having divided its length in two places.

*To the naked eye the worm was semitransparent, white in colour, and shewed faint but definite transverse marking. When placed in saline it exhibited slight waving movements for a short time. From the severed ends of the cut portion there poured a copious stream, which created a visible cloudiness of the saline; some of this was collected, and in stained preparations shewed the presence of a number of very small round cells, 3 to 4 microns in diameter, displaying internally a faint cruciform structure, thus ⊂∩⊃ in all probability spermatozoa, which in nematodes, Dr. LEIPER informs me, are aflagellate.

After preliminary examination in saline, the worm was dehydrated in solution containing 70 per cent. alcohol and 5 per cent. glycerine, and subsequently mounted in glycerine jelly.

Measurements.—Length, 58 mm. Greatest breadth (towards the head), ·45 mm. (at a distance of 2 mm. from the end). Average breadth, ·35 mm.

Breadth of head, ·2 mm. (at a distance of 1 mm. from the end). Breadth of tail (at the bend), ·25 mm., (at the extreme tip), ·1 mm.

Microscopical Examination: I., of the Male Filaria.—Under the low power by transmitted light the substance of the worm appears of a brownish colour, invested by a transparent cuticle about 8 μ in thickness and composed of an inner and an outer layer. Throughout the greater part of the length of the worm the cuticle shews fine transverse striation, about 1 to 2 μ apart, but not apparent in the portion enveloping the head and the extreme tip of the tail.

Beneath the cuticle, and running in the long axis, can also be seen the longitudinal striation of the dorsal and ventral musculature, by contraction of which the envelope is thrown into shallow transverse folds, giving the faintly corrugated appearance visible, as already mentioned, to the naked eye at the original examination.

The anterior extremity tapers from a width of ·4 to ·2 mm., and is blunt pointed, without obvious papillæ protecting the minute central oral aperture. At this point the cuticle is invaginated to communicate with the fine cuticular lining of the pharynx and its prolongation into the œsophagus.

At a distance of ·4 mm. from the orifice the alimentary tube is deflected laterally in a sharp angular bend to the right, followed by a broad loop to the left, and is then continued on in a fairly straight course, but at various points it is possible to make out the fine coils of either the mid and hind gut or the genital tubules.

On either side of the interior end of the tube are seen small groups of tissue possibly framework supporting the nerve structures encircling the œsophagus.

The caudal end is curved at a blunt angle towards the cloacal aperture at a distance of under ·1 mm. from the tip, and projecting from the aperture is seen a delicate filamentous spicule, part of the copulatory organ, ·25 mm. in length.

No papillæ whatever are to be made out on the tail.

II., of the Tumour and Gland.—The nodule from which the worm had been removed was examined in the fresh state, but failed to shew the presence of a second or female worm, or evidence of microfilariæ in the wall of the cystic interior.

Sections shew the nodule to be composed of fibrous connective tissue, and round cell infiltration traversed by collapsed spaces, lined with what are possibly the remains of a flattened endothelium.

These spaces may represent original lymph channels blocked by the lodgment of the filaria, and subsequently shut off and enclosed by the resulting zone of inflammatory reaction and fibrous connective tissue formation.

No filaria or microfilariæ could be seen in the sections.

The excised epitrochlear gland revealed nothing abnormal, either in smears from the fresh tissue or in stained sections.

Examinations of the patient's blood were made on several occasions, both by day and

* The drawings submitted by Capt. GRAHAM PORTER have not been reproduced. Specimens were shewn under the microscope at the meeting.

right, in fresh and stained films, but failed to shew the presence of any microfilariæ, and gave no evidence of leucocytosis.

A differential leucocyte count taken on the day after the operation was as follows:—

Polymorphs ...	47·0 per cent.	Large lymphocytes...	8·5 per cent.
Large mononuclears ...	2·0 ,,	Eosinophils... ...	3·5 ,,
Small lymphocytes	38·0 ,,	Basophils	1·0 ,,

Case II.—Pte. Petar Mitrovitch, a Serb, was admitted to hospital on June 27th, 1918, under the care of Capt. McDougall, R.A.M.C., suffering from a swelling of the right side of the nose.

History.—For the past year he had been stationed with Serbian troops in a Turkish village on a part of the Macedonian front. Two months previous to his admission in hospital the right side of the face suddenly became swollen. He described the swelling as white and painless, with a burning and itching sensation over the side of the nose.

The condition of the face subsided somewhat as the result of local applications, but the swelling on the side of the nose persisted.

On Admission.—On the right side of the nose, and just below the right lachrymal sac, was a small, moveable, tense cystic swelling, not involving or adherent to the skin.

There was no evidence of obstruction to the lachrymal duct, and no conjunctivitis or blepharitis.

Operation was performed by Major Mills, R.A.M.C.T., three days after admission. Incision was made over the swelling, and a small cyst was exposed and dissected out. Its wall was thick and adherent to the underlying tissues; when cut into, a small quantity of opaque glairy fluid exuded from the definite cavity occupying the interior of the cyst, together with a delicate filiform worm, which was extracted, and has been found to measure about $3\frac{3}{4}$ inches (94 mm.).

The skin incision was closed with horsehair sutures and a firm pad and bandage applied. A week later (July 7th) the stitches were removed.

On July 9th a small, hard, moveable swelling, probably an inflamed gland, was noticed on the left side, under the lower jaw.

On July 24th there was a recurrence of the cystic swelling at the side of the operation wound; there was also slight enlargement of the glands on each side just below the symphysis of the lower jaw.

Blood-film examinations, made on two separate occasions, failed to shew the presence of any microfilariæ.

I have at present no further clinical particulars of this case, and it is thanks to the kindness of Capt. Lees, M.C., R.A.M.C., who sent me the notes and the specimens of the cyst and filariæ that I am able to place them on record.

I subsequently sent the notes and specimens of the two cases above described to Dr. R. T. Leiper, who has very kindly indentified them both as belonging to the same species; in the one case the mature male, the first hitherto recorded, and in the second case, the immature female of *Filaria conjunctivæ* of Addario.

The female specimen is incomplete and unfortunately the head is missing; what remains measures 94 mm., but the character of the finely striated cuticle and the appearance of the blunt pointed tail, leave little doubt as to its sex and species.

The cyst which contained the worm measured $\frac{3}{4}$ by $\frac{1}{2}$ inch, and was too friable to admit of section cutting

Search with a hand lens and films from the inner wall failed to reveal a second filaria or any embryos. Moreover, the absence of embryos from the body of the worm is evidence of its immaturity—a feature also of most of the few recorded specimens of *F. conjunctivæ.*

Measurements—Length (incomplete), 94 mm. Breadth, ·5 mm. Thickness of cuticle, 7–8 μ. Breadth of tail, ·15 mm.

As in the male specimen, the cuticle is transparent and marked by very fine transverse striations, 1–2 μ apart and visible throughout the length to the tail.

Viewed by transmitted light under the microscope the substance of the worm,

between the cuticular layers on each side is of a brownish colour, and shews the coarse coils of the uterine tubules throughout the greater part of its length crowded with immature ova measuring 2–3 μ.

In addition can be seen the fine longitudinal markings of the muscle fibres.

The tail differs from the male in the absence of spicules, in not shewing any upward curves, and ending abruptly in a blunt point.

The anus is not visible and there are no papillæ to be seen.

The tip of the tail, viewed from the side, shews one of the lateral pits as described in Grassi's detailed account[1] of the anatomy of the worm, corresponding to the point at which the cavity of the cœlom pierces the external cuticle and apparently forms a very small short canal measuring 4–5 μ across.

Previously recorded cases in Man. Though first named by Addario in 1885 as *Filaria conjunctiva*, this species had been already observed, but not named by Dubini, who found the immature female worm measuring 115 mm. in the eye of a man in Milan.

Addario's specimen of the female worm enclosed in a nodule, the size of a pea and measuring 95 mm., was extracted by Vadela from the conjunctival sac of the right eye of a woman, aged 70, a native of Catania, in Sicily, in whom a year later a second worm was found in the same eye.

Babes[1] also had described the same species at an earlier date in 1879 and 1880, as occurring encysted in a calcified nodule in the gastro-splenic omentum of a woman, in Buda-Pesth. He named it *F. peritonei hominis*. This specimen was an immature female, measuring 190 mm.

In 1887 Grassi published a full description of the anatomy of the mature female worm, and named the species *Filaria inermis*, on account of its "unarmed" appearance, due to the absence of papillae from the head.

The female specimens so far recorded in man range in length from 90 to about 200 mm., although met with in horses and asses as short as 50 to 60 mm. The question of the differences in length is, however, one depending on the degree of maturity of the worm.

Grassi's *F. inermis* measured about 16 cm. long and ·47 mm. broad. The cuticle was 9 μ in thickness, transparent and marked by fine transverse striations throughout the greater part of the length of the worm, but disappearing towards the head and the extreme end of the tail. It presented an outer finely ridged epidermal layer and an inner layer or corium, and below it was visible the coarser longitudinal striae of the dorsal and ventral musculature.

The head was slightly tapering and truncated, devoid of papillæ, with a very small terminal central orifice formed by a continuation of the cuticle into the narrow funnel-shaped pharynx which widened out to form the short œsophagus of ·6 mm. length and thence continued on as the main gut.

The greater part of the cœlom was occupied by the coils of the uterine tubules which were crowded with embryos, some still within the ova, others free, measuring 350 μ in length and 5·5 μ in breadth, with blunted anterior extremity and very thin finely curved tail.

These tubules communicated with a pair of genital tubes which unite a little behind the commencement of the main gut, and find an outlet at the vaginal opening piercing the cuticle at a point ·3 mm. from the oral aperture.

The tail is described as curved with blunt pointed extremity, and the anus, not always visible, as a cleft a short distance above the tip of the tail.

Viewed from the ventral surfaces the end of the tail presented a median, and two lateral pitted markings suggestive of canalicular orifices, but more probably points at which the cœlomic cavity comes into close apposition with the external layer of the cuticle.

Grassi considered that his specimen differed from that of Addario and, therefore, described it under a new name as belonging to a separate species.

But it is now generally agreed that *F. inermis* is synonymous with *F. conjunctivæ*, as are also Babes' *F. peritonei hominis*, Pace's[2] *F. palpebralis* obtained from a cyst in the upper eyelid of a Sicilian native of Palermo, in 1887; Rivolta's[3] *F. papillosa*, a mature

female worm, measuring $5\frac{1}{2}$ cm., found in the eye of an ass, in Pisa, and *F. apapillocephala* of CONDORETTI.[6]

The most recent example of *F. conjunctivæ* was recorded by ALESSANDRINI[2] in 1906.

This case is of particular interest, for the site of worm was almost identical with that in Pte. J. B. (Case I.)

A painless tumour had persisted for 13 months on outer surface of the upper part of the left forearm of a woman, aged 25. Subsequently the arm became painful and swollen, and an abscess which had formed burst, discharging pus and with it the filaria.

ALESSANDRINI suggests that the infection had been conveyed from a horse or an ass through the *Chrysops excutiens* fly.

REMARKS.—The male filaria obtained from the arm of Pte. J. B. was at first regarded as possibly belonging to the species *Onchocerca volvulus* (LEUCKART, 1893), which is well known to occur among the natives of West and Central Africa, giving rise to the formation of subcutaneous nodules in various parts of the body. Native French colonial troops from the Senegal were frequently passing through the hospital, and were thought likely to have provided a possible source of infection through the agency of a mosquito or some biting fly.

The question of geographical distribution, therefore, seemed to have been accounted for, and on clinical grounds also there was some support in favour of this filaria belonging to the Onchocercæ.

Such access as was possible to the literature of onchocerciasis in Salonika shewed, however, that though the worm presented certain resemblances in its fine cuticular striation, and the absence of papillæ from the head, it was of abnormal length for the male *Onchocerca volvulus*, which has not been recorded longer than 35 mm., and its tail shewed none of the typical papillæ presented by that of the *Onchocerca volvulus ;* further, it was the only worm present in the tumour. Its identity was, therefore, unsettled.

It was not until my return to England, some months later, that I had an opportunity of consulting Dr. LEIPER, who unhesitatingly pronounced the specimen not to belong to the Onchocercæ, on the following grounds :—

(1) The geographical distribution : *Onchocerca volvulus* has never yet been found in Europe or outside Africa.

(2) The structure of the tumour enveloping the worm is more spongy and much less fibrous than in the nodules of Onchocerca. The latter also invariably contain at least two female and several male worms, and swarm with embryos.[7]

(3) The appearance of the cuticle is quite different, the transverse striations being finer, and there being a total absence of the coarse ridge-like cuticular folds common in the *Onchocerca volvulus*.[8]

(4) The formation of the tail, including the absence of any terminal papillæ, is altogether unlike that of *Onchocerca volvulus*.

Dr. LEIPER has further identified the two specimens as being the male and female types of *F. conjunctivæ* of ADDARIO, the former for the first time on record.

The anatomical structure and appearance of the two specimens bear every resemblance to these species, whose synonyms have already been mentioned.

F. conjunctivæ has hitherto only been found singly, usually in a state of immaturity, within the substance of small spongy fibro-cystic nodules occurring in the neighbourhood of the eye, but not restricted to that region.

So far as at present known its geographical distribution is confined to South-Eastern Europe.

Source of Infection.—Both cases here described occurred in the neighbourhood of horse and mule lines, but the animals not being regarded as possible hosts were not examined.

In elephantiasis (*F. bancrofti*)—possibly also in onchocerciasis, for the two conditions have been found together in a number of instances in Central Africa[9]—the transmitting agent of infection is known to be the *Culex fatigans* and other varieties of mosquito.[10] It is possible, therefore, that transmission of the embryos of *F. conjunctivæ* may be effected

by a mosquito, or a biting fly, such as a *Chrysops excutiens*, or the stable fly *Stomoxys calcitrans*, the intermediary hosts of *Filaria labiato-papillosa*.[11]

Presence of Microfilariæ in the Blood.—Neither of the patients, though examined both by day and night, shewed any microfilariæ. In the existing records of the few cases of *F. conjunctivæ* no mention has been found as to the condition of the blood. This and the nature of transmission of infection, as to whether the filarial embryo may develop at the site of its introduction, or, gaining the blood or lymph circulation, become lodged in a capillary, and there give rise to the formation of the fibro-cystic tumour, are important points requiring investigation.

Occurrence of other forms of Filariasis in Macedonia.—As the result of inquiries made of several distinguised French and Serbian pathologists, to whom I shewed the male specimen in Salonika, including Professor LISBONNE, M. JOYEUX and Dr. HIRSCHFELDT, I learnt that no case of filariasis at all resembling that of Pte. J. B. had come to light among French or Serbian troops up to June, 1918, also that in spite of the number of native troops from the Senegal no case of onchocerciasis had been reported.

This was also confirmed by M. GAU, Pathologist to the 3rd French Hospital, who was making a special study of the subject of filariasis among native colonial troops from Madagascar, Senegal and Indo-China. He had met with three cases of infection by *Filaria loa*, and in the course of several hundreds of blood examinations had found the embryos of *F. bancrofti* and *F. perstans* in a certain percentage of African natives, who, as "carriers," thus become potential sources of the spread of filarial disease in Macedonia through the transmitting agency of the ubiquitous mosquito. As a result it is very conceivable that the geographical distribution of filariasis may in future embrace regions where infection by *F. bancrofti* and *loa* have been quite unknown.

In conclusion, in addition to my indebtedness to Dr. LEIPER—without whose kindness and wide experience it was impossible to identify the filariæ—I have to express my special thanks to Capt. A. A. LEES, M.C., R.A.M.C., for his help in connection with Case I., and his kind thought in forwarding me the specimen and notes of Case II., to Major MILLS and Capt. MCDOUGALL for permission to publish the case, and to Lieut.-Col. WENYON, C.M.G., R.A.M.C., for kindly providing me with sections of the tumour from Case I.

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